LECTURE

ON THE

ADVANTAGES DERIVED FROM CULTIVATING

THE

ARTS AND SCIENCES.

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LECTURE.

We are always in search of novelty. Does a traveler return from a journey in a strange land, or a voyage in an unknown sea, how eagerly do we apply to him for an account of what he has seen! Does a philosopher or artisan elicit any new discovery, we are never satisfied until made acquainted with it! Whether the information thus received be applicable or not to any of the ordinary useful purposes of life, it is always sought with ardour. Civilised man is thus incessantly occupied in the pursuit of new information and the extension of his sphere of knowledge. He first makes himself acquainted with the natural objects by which he is more immediately surrounded, and especially those which minister most directly to his daily wants, and is then impelled by the cravings of an intellectual appetite to look abroad into the world, and even beyond the common confines of the world, for new intelligence. Not content with acquainting himself with the external characteristics of the objects upon which he directs his attention, he exerts his powers of observation and reason to become familiar with their more intimate qualities and constituents, and the mutual agencies these exert upon each other. His innate curiosity and love of information even carry him beyond the limits of what is termed *natural* science—or the observation of causes and effects—and he launches out into the reasonings and conclusions constituting *abstract* science. It is this insatiable craving after knowledge which has led us, on the present occasion, to assemble in this hall, and elevating ourselves, as it were, above the stage whereon we are employed in our daily pursuits, look at the things which are beyond.

There are those who would have us believe that all knowledge is superfluous which cannot be immediately applied to some of the

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useful purposes of life. Such persons, when told of any new observation or discovery, raise the cry, "*cui bono*," to what use can it tend? By such an appeal, those who may not be able to comprehend at once the bearing or application of the new knowledge are often puzzled by the quibbler, who thus derives a kind of selfish satisfaction. But he would have little cause of triumph, were he capable of tracing the advantages which, sooner or later, crown the acquisition of every new addition to human knowledge. Let us fancy, for a moment, that one of these *ultra utilitarians* had met Columbus on his return from his first voyage, and, after congratulating him on his safety, he had asked the noble navigator what good he expected to accrue from his discovery of new land in the west? Columbus might have told him of the gold that was to be obtained, and the heathen that were to be converted; but neither he nor the utilitarian could ever have imagined the glories that were to ensue, from the establishment in the new world, of empires teeming with a population possessing all the arts and appliances of the highest civilisation! Let us imagine that some *cui bono* had asked the first observer of the expansive power of steam, what use could come of such knowledge? It is very evident that the philosopher, in his answer, could never have anticipated the mighty energies which steam power was destined to put forth at another day! Let us fancy, again, that the first observer of the little snapping spark elicited by the friction of amber had been asked by a caviler, what benefit he expected the world to derive from a discovery apparently so trifling? In all probability the answer would have been such as to have afforded the *cui bono* a selfish triumph; for certainly the first observer of the little electric spark never imagined that successive investigations into electric phenomena—most of which were, perhaps, prompted by mere curiosity—would finally lead to the discovery of the lightning rod, by which life and property are now protected, and the dreaded thunderbolt rendered harmless—silently conducted into the bowels of the earth!

And so it is with other new acquisitions of knowledge, the advantages of which cannot be fully comprehended until time and genius have developed their utility and assigned them their proper bearings. So many discoveries deemed idle at first, and only fit to administer to childish curiosity, have subsequently been made to subserve the most important uses in the arts and sciences, that we should be cautious in contemning any thing new, as beneath the notice of a rational curiosity, lest some valuable invention or improving knowledge may be lost. Insulated phenomena and independent facts are objects of great importance to the inquirer into natural philosophy, as it is by observation of these that he finally succeeds in ascertaining those general principles and special laws to which all nature is subservient.

The mind is sometimes originally constituted with such warps and obliquities, that, like glass with an uneven surface, objects seen through it, or reflected by it, appear always distorted. At other times it seems to receive but little impression from any thing that does not, in some degree, partake of the marvelous, occult, or far-fetched. Individuals thus endowed are apt to be speculative, and are often so ingenious and specious in their arguments as to captivate the attention and gain the approbation of many. It is inconceivable what an immense amount of intellectual energy has been thrown away in pursuit of phantoms by these pseudo-philosophers and their infatuated adherents. But it is, perhaps, less singular that individuals should occasionally be found with such mental obliquities and erroneous notions as lead to visionary or false opinions and doctrines, than that they should be able to gain so many advocates, often among persons of much general intelligence. Whole communities, indeed, are sometimes enlisted in advocating the most preposterous views, and this is frequently the case when the intellect has been partially excited into action, and not afterwards fed with the requisite supply of correct information. "A little learning," says the poet, "is a dangerous thing." But this trite precept should not be received without some qualification. For if only a few of the sound principles of nature be sown in a fertile mind, properly cleared from the weeds of prejudice, the fruits of knowledge which may in due time be gathered from them will be rich and valuable. To carry the metaphor thus borrowed from rural life a little farther, a few seeds scattered upon a small spot advantageously tilled, will often produce far more profit than the most profuse sowings upon a large plantation carelessly managed.

Once accustomed to intellectual stimuli, we must be plied with them, and if not furnished with profitable topics, we are prone to avail ourselves of those which are unprofitable and mischievous. In the absence of all intellectual resources, we often fall into physical excesses, as is frequently the case in country places, where a young man, on returning from college with ideas elevated and tastes refined, meets with no congenial associates.

Sometimes the active mind, withdrawing itself from the influence of external impressions, feeds upon its vain imaginings, which often raise anxious fears about the bodily health, magnifying the most trifling pain or inconvenience into some inveterate malady. The regular physician is, perhaps, first consulted, and finding little or no necessity for medicinal preparations, conscientiously advises a recourse to those great restoratives—occupation of body and mind. But this advice is seldom taken, and the victim either seeks consolation from some other regular source, or, what is very common, listens to the seductive promises of some artful empiric, who administers cheerfully to all his whims and conceits. In the pleasant fields and forests of natural science, specifics may be found for all the imaginary ills and moral ailments to which individuals with active intellects are exposed. Were Belinda a botanist, she would find so much to admire in this charming branch of human knowledge, that she would devote more time to her indigenous and exotic plants and flowers than she now does to the affairs of her neighbours. Were Pharistus more sensible of the fascinating subjects for investigation presented by mineralogy, chemistry, or any other sister science, he would find himself usually in much better health and spirits, and far less disposed to cavil at, censure, and condemn the actions and motives of all that come within his sphere of observation.

The world had grown old, and the Christian era advanced to its seventeenth century, before it was discovered that there could be no sound knowledge of physical subjects gained through the powers of abstract reasoning alone, or by any other means than through the assistance of observation and experiment. Persons who, through the aid of these, have become enlightened, as at the present day, can hardly be brought to believe that the human intellectual faculties were ever seriously exercised in such vain attempts to fathom knowledge as were made, up to a comparatively modern date, or the extent of unmeaning jargon, once recognised as profound learning, before Gallileo, Bacon, and their followers, tore the cap and gown from the pedant, and taught that an imposing garb and grave look can never make a dogma true, or enable one to demonstrate facts as effectually by syllogism as by experiment.

After the establishment of the Baconian system, of trusting entirely to the results of observation and experiment in the attainment of knowledge, the impulse given to investigation was immense. So rapidly, indeed, did physical facts accumulate through the application of experiment, that, to prevent the reason from losing itself in the countless mazes of particulars, it became necessary to subject these to some general arrangement. Substances possessing analogous properties, and which were subservient to similar laws regulating their separate or mixed conditions, were classed together, so that the mind was relieved from the burthen of separate facts and phenomena. And thus originated the sciences, which may be strictly defined, the knowledge of many single facts orderly arranged and digested, so as to become attainable by one.

In relation to the acquisition of knowledge, it may be remarked as a striking characteristic of man, that his wants seem to increase as the limits of his information are extended. This is exemplified in the contrast exhibited between the comparatively incurious savage, whom some treaty about his hunting grounds may have brought among us, and the European visiter, who has voluntarily encountered the dangers of the ocean, merely to gratify his prying curiosity and gain new materials for thinking.

After the wonders that have been revealed by science, and achieved in the arts, we are prone to ask whether there is any room for new discoveries or inventions. The rapidity with which in our age these achievements have been accomplished, has kept us in a state of perpetual wonder, and like the sailor, who, whilst witnessing the feats of the necromancer, was blown in safety through a window by an accidental explosion of gun-powder, rub our eyes and wonder what is to come next. So many things, which, if ever thought of, were at the time deemed impossible, have been subsequently accomplished, that we are warranted in believing ourselves destined for a long period yet, to cry out, "*what next?*" The consequence of the increase of knowledge and the improvements in the arts, has been a wonderful multiplication of the conveniences and comforts of life; so that the average enjoyment of mankind is not only increased, but the average length of life actually extended.

Not only are we stimulated to inquiry into the arts and sciences by an innate taste for investigation and the pleasure derived from its indulgence, but by a pride of knowledge—if not individual—at least national. Time was, when nations enriched themselves by making war upon those they deemed weaker, and getting possession of spoils. So long as war was a trade, and the power to defend a duty, physical qualities were the most highly appreciated, and the possessor of brute force always took precedence of his weaker fellow, however superior in intellect. But, since this practice has almost ceased among civilised people, new sources of national wealth are sought, and these have generally turned upon a greater perfection in the arts. The rivalry maintained by civilised nations renders it important, nay imperiously necessary, that we shall endeavour to keep pace, if not outstrip others in this peaceful struggle, as otherwise we must always continue to pay a tribute, as regularly exacted as though imposed by the dictates of a conqueror. That, therefore, which we would scornfully refuse to the sword of Mars, we should be compelled to yield to the caduceus of Mercury.

And then, again, if our patriotism and pecuniary interests are not sufficient to impel us on the way of improvement, our personal safety demands that we should not allow other nations to outstrip us in the arts. Means of defence at one time deemed ample protection against the most formidable attacks, are now no longer capable of resisting an enemy with his improvements in warfare. Within a very short time we have known a Mexican fortress, long deemed impregnable, battered down by newly invented projectiles; and recent experiments made upon our own shores—fortunately in peaceful times—have demonstrated that walls constructed of ordinary materials are incompetent to resist the entrance and explosive power of Paixhan's horizontal missiles. Nothing but the hardest granite has yet been found capable of obstructing their course, and the many ramparts of less solid materials erected by nations at such immense expense of toil and treasure, no longer furnish the protection which they once so confidently promised. Such is the startling truth which meets us at a moment when the two most powerful nations on earth have fleets of armed steamers afloat, adapted to ocean navigation, by means of which armies may be landed on our shores in much less time than would be required to assemble an adequate force to repel them.

This march in steam navigation, both naval and commercial, has been gained upon us whilst busy in perfecting those unrivaled models of steamers and locomotives now carrying on our extensive inland transportation. Our first object was to apply the power of steam to overcome the great natural obstructions offered by the impetuous currents of our noble rivers. Other countries, not possessed of such inland channels, and carrying on nearly all their commerce upon stormy seas, were at the same time steadily bent upon rendering their steamers capable of overcoming the obstacles opposed by winds and waves. It is, therefore, reasonable that, by concentrating their efforts to achieve these ends, they should have excelled us in the structure of ocean steamers, as we have eclipsed all other nations in those adapted to river navigation.

But we should never suffer ourselves to be left in the rear of improvement. So far as self-protection demands, some promise is held out of retrieving measures. The structures of mighty steamers are now framing in our dock yards, one of which is intrusted to the skill of Philadelphia artisans, and the din of hammers forging the huge engines, is heard from the anvils of the Southwark foundry. It will, doubtless, be regretted by many present, that our first essay at ocean steamboat architecture had not been devoted to the promotion of those commercial ends, which, whilst they contribute to the prosperity of individuals and communities, tend to maintain peace among nations, not only by keeping up that friendly social intercourse which serves to remove prejudices from individuals and nations, but by so interlinking the pecuniary affairs of these as to cause the interests of all to be more or less injured by a war between any two. Instead of depending for peace upon the sordid considerations of self-interest, it would be infinitely more creditable to nations could they be bound in amity by those strong moral and religious lessons which teach "peace on earth, and good will to man." But so long as the advocates of these principles are too few in number to sway the destinies of governments, they must hail with pleasure any other influence which tends to guard mankind from the horrors of war.

A ship has been pronounced the master-piece of human ingenuity, and the graphic and spirited descriptions of Falconer, and our own Cooper, have almost endowed her with life. Those attached to a ship by duty, are accustomed to talk of her as though one of themselves. Such a comparison with animated beings is, however, peculiarly applicable to the steamer, which requires to be plied with fuel and water as the elements of her life. Moved by an inward and concealed power, we hear her regular and forcible respiration, as her fluttering fins drive her rapidly through the liquid medium.

In one of those attractive windows in Chesnut street, where the fine arts look out upon the moving world, may be seen a sea view, representing that noble steamer the British Queen, without a rag of canvass set, the column from her smoke-pipe, and proud English flag streaming behind, and showing that the stiff breeze which she so effectually buffets, is, in nautical phrase, "right in her teeth." She has just passed one of those beautiful bright-sided packet ships, which but lately monopolised the profitable business of transporting passengers and merchandise across the Atlantic, and one may easily imagine the humiliating feelings of those on the deck of the late unrivaled "liner," now struggling close hauled, under double-reefed topsails, and scarcely able to "hold her own," as they see themselves passed so tauntingly by her too powerful rival, stowed with rich freight and crowded with passengers. How long must our country furnish such subjects to the marine artist? How long must the stars and stripes remain exposed to the humiliation of being passed upon the common seas by other banners? How long must we continue to enrich the overflowing coffers of foreign capitalists by paying them for conveying us and our merchandise across the Atlantic? How long are we to remain in this condition of almost recolonisation, waiting for instructions from Europe to guide us? Answer these appeals, merchants and capitalists, and if the almost certain prospect of pecuniary reward will not impel you to engage in promoting that maritime enterprise, which is now enriching the stranger and humbling your flag, yield something at least to the nobler impulses of a laudable national pride.[1]

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[1] As some counterbalance to the condition in which our country finds itself in the picture just drawn, we are proud to add that it was a countryman of ours who first demonstrated the practicability of crossing the Atlantic ocean in a vessel propelled by steam, and whose efforts to adapt steam to regular nautical purposes merely failed for want of that patronage and support which have elsewhere led to success. For the following particulars, relative to Captain Rogers and his first Atlantic steam voyage, we are indebted to the kindness of our friend Judge Hopkinson of this city, who was personally acquainted with him, and entertains a high respect for his memory.

Captain Moses Rogers was a native of Connecticut, an active, enterprising, intelligent man, and a complete seaman. He at one time commanded a steamboat running between Philadelphia and Bordentown, and was subsequently employed in the same way in some of the more southern waters. His widow and family now reside in this city. The steamship in which he first crossed the Atlantic was called 'THE SAVANNAH,' and left New York on the 28th of March, 1819, arriving at Savannah, Georgia, on the 6th of April. After a considerable time spent here in putting things in order, taking in fuel, &c., he sailed for Liverpool, where he arrived on the 20th of June, having, on the passage, used her steam power or sails as the wind would permit.

About the middle of July the Savannah left Liverpool for the Baltic, reached Elsineur on the 9th of August, and left it on the 14th of August; put into Stockholm, and left it on the 5th of September; went to Cronstadt, and from thence to St. Petersburgh. On the 18th, the American minister and other foreign ministers came on board, and the steam was put on. The Russian high admiral and other distinguished persons also visited the ship.

In regard to the ornamental arts, the cultivation of which calls in requisition every thing which can contribute to beauty and grace, I may observe that there is a natural grace, which results from a happy organisation, and which shows itself not only in the human species but in many of the lower animals. The movements of the horse, the deer, the swan, and so forth, are graceful. So are those of a child. I do not, however, mean the kind of grace thus referred to as unconnected with the faculties of perception and reflection, but that power of creating and conferring adventitious beauty, which adorns and renders every subject pleasing to the senses. The grace to which I allude has its origin in the head, and is the result of proper culture applied to a well-organised mind. The expressive movements of the dance, and the effective powers of the musical performer are prompted by it. Without that grace which is imparted by a refined taste and proper cultivation of the intellect, the efforts of the hands and other muscular organs must always fall short in their attempts to give pleasing effects. The expression given to forms thus indicates the degrees of physical refinement and taste of their producers, and consequently we are enabled to read, so far as these are concerned, the mental culture not only of our contemporaries, on whatever part of the globe they may exist, but even of the ancients of the classic ages, in those noble architectural monuments, exquisite statues, and other specimens of elegant and embellished design, which time has spared, as so many illustrations of what the poet tells us in that impassioned exclamation—

> *Mind, mind* alone, bear witness, earth and heaven!
> The living fountains in itself contains
> Of *beauteous* and sublime: here, hand in hand,
> Sit paramount the graces!——[1]

The French, either from a superiority of natural endowment of ideality, or from a more cultivated taste in all that relates to the ornamental arts of civilisation, lay us under a heavy tax for the

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She set off on her return the 10th of October, went into Copenhagen, and finally returned to Savannah, from thence went to Washington. Her log-book is kept with great precision, showing when the steam was used and when not. Whenever the wind would serve, the fuel was saved, of course. The wheels were made of iron, and when not in use were folded up along side. The operations of spreading out and closing the wheels resembled those of the fans which are drawn into a tube.

[1] Akenside.

produce of their skill. They have those unbounded resources of imagination, which not only give rise to beauty of form, delicacy and harmony of colouring, and every other qualification essential to external beauty, but they possess those kaleidescopic resources of fancy that administer to fashion, the caprices of which are not always subservient to the rules of loveliness.

In referring to the advances made by the French in the ornamental arts, it is but proper to add that their genius has enabled them to attain excellence in other departments. The French intellect has, indeed, shown its power to compass almost every thing, from the most fanciful and exquisite *bijouterie* to the sublimest achievements in chemistry, natural philosophy, and astronomy. By the assistance of her arts, France has been enabled to countervail, as it were, the disadvantages of geographical position and climate, as is illustrated, among other things, by her supplying herself with domestic sugar from the root of the beet, and oil from the seed of the colza,[1] articles for which we, in common with many other nations, are almost wholly dependent upon tropical fields and polar seas!

But among her intellectual achievements in overcoming physical difficulties, there is one upon the records of her dark days,—I mean politically speaking,—which, perhaps, more than all others, excites our admiration, constituting, as it does, a triumphant example of the successful application of modern inductive philosophy, and showing, at the same time, that reliance upon mental power which indicates true greatness both in individuals and nations. I allude to the sublime experiment to which she was driven at a time when completely surrounded by enemies on land and at sea, and thus cut off from all external resources. It is well known, that in the composition of gunpowder, the most essential ingredient is nitre or saltpetre, which has not been found, in a mineral state, in France. Without gunpowder, her physical powers were palsied. What did France do in this appalling emergency? Supplicate for peace, which she could never have obtained upon equitable terms? No! She appealed to intellect to come to her rescue, and called upon her *savans* for aid! Nor did these disappoint her! That material, which was not to be found ready formed in the soil of France, they extorted by chemical process from the common atmosphere!

Of the casual observations made by men gifted with minds capable of turning them to advantage by proper reflection, that which led to the invention of the mariner's quadrant deserves the particular notice of Americans, and especially of Philadelphians. Thomas Godfrey, to whom the credit of original invention is unquestionably due, followed in this city the trade of a glazier. He was self-taught, but, nevertheless, succeeded in making himself a proficient in mathematical studies, of which he became enamoured by the perusal of a book upon the subject which accidentally fell in his way. One day, whilst replacing a pane of glass in the window of a house on the north side of Arch street, opposite a pump, a girl, after filling her pail, placed it on the sidewalk. Godfrey, on turning towards it, saw the sun reflected from the window on which he had been at work, into the bucket of water, and his philosophic mind, seizing upon the observation, was thus led to conceive the plan of an instrument by which he could draw the sun down to the horizon by a contrivance incomparably superior to any that had ever before been used for the purpose of ascertaining angular measurements.

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[1] A variety of cabbage, *Brassica oleracea.*

In almost every treatise upon astronomy, navigation, or natural philosophy, we find this instrument called *Hadley's* quadrant. So long a period has elapsed since the death of Godfrey, that although he was one of our own citizens, I may, perhaps, be pardoned for reviving his recollection, and stating, on the present occasion, the grounds of his claim. James Logan's letter to Halley, the great mathematician, and president of the Royal Society of London, giving a minute account of Godfrey's invention, is dated Philadelphia, May, 1732. In this letter we meet with the following plain and interesting history.

"A young man, born in this country, *Thomas Godfrey* by name, by trade a glazier, who had no other education than to learn to read and write, with a little common arithmetic, having in his apprenticeship, with a very poor man of that trade, accidentally met with a mathematical book, took such a fancy to the study, that, by the natural strength of his genius, without any instructor, he soon made himself master of that, and of every other of the kind, he could borrow or procure in English: and, finding there was more to be had in Latin books, under all imaginable discouragements, applied himself to the study of that language, till he could pretty well understand an author on these subjects, after which,—the first time I ever saw or heard of him, to my knowledge,—he came to borrow Sir Isaac Newton's Principia of me. Inquiring of him hereupon who he was, I was, indeed, astonished at his request, but after a little discourse, he soon became welcome to that or any other book I had. This young man, about eighteen months since, told me he had for some time been thinking of an instrument for taking the distances of stars by reflecting speculums, which he believed might be of service at sea; and not long after, he showed me a common sea-quadrant, to which he had fitted two pieces of looking-glass, in such a manner as brought two stars, at almost any distance, to coincide, the one by a direct, the other by a reflected ray, so that the eye could take them both together, as joined in one, while a moving label or index on the graduated arch, marked exactly half their distance."

But I need not proceed further with the minute description of Mr. Logan of the principle and operation of Godfrey's quadrant, as these could not be properly shown to those unacquainted with them, without the assistance of such means of ocular demonstration as it would be inconvenient to employ on the present occasion. Suffice it to say that Godfrey made a model in wood of the instrument described by Mr. Logan, and afterwards had it constructed of brass. This new quadrant was given for trial to a ship captain in the West India trade, and at Jamaica shown to the commander of an English ship, who took an account of it—some say the instrument itself—to Hadley, a mathematical instrument maker in London. Here it met with some alterations, which, however, did not and could not change the optical principle upon which its construction was founded, but merely added to its convenience and improved its appearance. Hadley succeeded in securing a patent for this instrument, although the claim of Godfrey, as its original inventor, was clearly established by Mr. Logan, and appears to have been recognised by the Royal Society of London, who sent Godfrey a reward, consisting of household furniture, to the value of £200.

The priority of the invention of the sextant or quadrant has been claimed as undoubtedly due to Newton. Sir John Herschell informs us, in his recent Treatise on Astronomy, that Newton communicated a *description* of such an instrument to Dr. Halley, who suppressed it. The description was found, after Halley's death, among his papers, in Newton's handwriting, and communicated by his executor to the Royal Society, twenty-five years after Newton's death, and eleven after the publication of Hadley's claim.

Now, if this statement be true, and Newton's description was suppressed in the way stated, it goes to show that Godfrey, at least, who was on this side of the Atlantic, and previously to his invention, maintained no correspondence, either directly or indirectly, with Europe, cannot be suspected to have had any knowledge of what Newton had done. Mr. Logan's letter to the Royal Society of London, written after he found the one addressed previously to Halley, had been entirely neglected, and whilst all the circumstances were yet fresh on his mind, shows most conclusively that the quadrant was not only invented in this city many years before the discovery of Newton's description, but was actually in use nearly two years prior to the date of Hadley's claim. The letter, dated Philadelphia, June, 1734, states that it was then four years since Thomas Godfrey invented his quadrant, "as has been abundantly proved by the maker and those who had taken it with them to sea, and there used it in observing the latitude, and brought it back again to Philadelphia before the end of February, 1730-31; when it remained in my keeping some months immediately after. It was, indeed, unhappy,"—continues Mr. Logan, in a strain of friendly solicitude for Godfrey's reputation that cannot be too much admired,—"it was, indeed, unhappy, that having it in my power, seeing he had no acquaintance nor knowledge of persons in England, that I transmitted not an account of it sooner. But I had other affairs of more importance to me; and it was owing to an accident which gave me some uneasiness, viz., his attempting to publish some account of it in print here, that I transmitted it at last in May, 1732, to Dr. Halley, to whom I made no doubt but the invention would appear entirely new; and I must own, I could not but wonder that our good will at least was never acknowledged. This, on my part, was all the merit I had to claim; nor did I then, or now, assume any other in either of those instruments. I only wish that the ingenious inventor himself might, by some means, be taken notice of, in a manner that might be of real advantage to him."

The conduct of Halley in suppressing the description given by Newton, and not replying to Mr. Logan's letter, containing a full account of the successive steps by which Godfrey had been led to invent his quadrant, is not a little mysterious. The manner in which Mr. Logan stood by and defended the obscure philosophic glazier, in this instance, shows him to have been a man of great magnanimity, as he had himself high claims to mathematical proficiency. Were this the only deed by which he had served this city and country, it would entitle his memory to our lasting veneration.

Nearly a century has now passed away since another citizen of Philadelphia, who had a perfect knowledge of the just claim of Godfrey, as the original inventor of the quadrant, held this language relative to his title to be ranked among the highest class of those who deserve to be remembered by posterity:—

"All civilised states have thought it an honour to have men of great ingenuity born or bred among them. Many cities of ancient Greece had long and sharp contentions for the honour of Homer's birth-place. And, in later times, volumes have been written in Europe in disputing which city had the true claim to the invention of the art of printing. Nor is it to be wondered that mankind should be so generally eager in this respect, since nothing redounds more to the honour of any state than to have it said that some science of general utility to mankind was invented or improved by them."[1]

The relics of Godfrey have, within the last year or two, been removed by pious hands from the spot where they were originally interred, now a neglected field, and carefully deposited within the precincts of that beautiful rural retreat for the dead—Laurel Hill Cemetery.[2] Immediately on entering this place, one may see on the top of the bank, at the right of the main avenue, a fragment of soapstone, on which some remaining letters, rudely etched, barely suffice to show that for nearly a century it has marked the grave of one, whose philosophic mind overcame all the obstacles opposed to its developement by poverty and obscurity;—of one who has earned the lasting gratitude of all concerned, either directly or indirectly, in nautical pursuits, by inventing the only instrument that can securely guide the ship when far from land! Shall a fragment of the most perishable stone be suffered to mark for but a few years longer the grave of Godfrey? In this age, when we enjoy so many advantages from the improvements in the arts and sciences, we should surely be guilty of the deepest ingratitude did we neglect to give some expressive and lasting token of our remembrance and veneration for so great a benefactor to his species.

Britain claims the distinction of having greatly excelled all other countries in the vast extent and perfection which she has given to most of the arts of civilisation. The results of her science and skill, in the application of mechanical contrivances to assist the efforts of the human arm in producing manufactured goods, are most strikingly displayed in the instance of her cotton fabrics. Many kinds of these were, but a few years ago, imported from the East Indies, where the cotton grew, and manual labour was only about one seventh of the low price for it in England. But the skill and science concentrated in Britain enables her now to bring the material from the other side of the globe, convert it into fabrics, and return these to the natives of India at lower prices than they can make them for themselves.

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[1] See Pennsylvania Magazine for 1757–58 for the letters of Logan, Godfrey, &c.: also, Allen's American Biographical and Historical Dictionary, art. GODFREY.

[2] This was done by J. F. Watson, Esq. of Germantown.

Since the ingenuity of man has done so much to relieve his hands, by consigning a large portion of the labour to his head, the diffusion of intelligence has become absolutely necessary to make a people eminently successful in the application of tools and machinery. These may be invented in one country and carried to another; but if the inhabitants of this be not sufficiently advanced in mental cultivation, they will never be able to use the implements to proper advantage, or compete with those from whom they derived the labour-saving contrivances. And even if these do finally succeed through dint of perseverance, upon looking back they will generally have the mortification to find those upon whose genius they first depended still ahead with new inventions, calculated to cheapen the prices, and thus, as it were, snatch the profits from their imitators. Nothing will, therefore, suffice to enable one people to compete with others engaged in similar pursuits, but an equality of intellectual cultivation sufficiently diffused. Among the interesting reports so frequently made by committees to the English house of commons, there is one upon the subject of the law prohibiting the export of tools and machinery, containing the evidence given by an intelligent manufacturer summoned for examination, which places this subject in a very clear light. "A cotton manufacturer," said he, "who left Manchester seven years ago, would be driven out of the market by the men who are now living in it, provided his knowledge had not kept pace with those who have been, during that time, constantly profiting by the progressive improvements that have taken place in that period: this progressive knowledge and experience is our great power and advantage."

England thus plumes herself, and with great reason, upon the superiority she possesses in most of her manufactures. The same committee of the house of commons, to whose report we just referred, hold this further language upon the subject :—

"The many important facilities for the construction of machines and the manufacturing of commodities, which we possess, are enjoyed by no other country; nor is it likely that any country can enjoy them to an equal extent for an indefinite period. *It is admitted by every one that our skill is unrivaled; the industry and power of our people unequaled; their ingenuity, as displayed in the continual improvement in machinery, and production of commodities without parallel, and, apparently, without limit.* The freedom (continue the committee) which, under our government, every man has to use his capital, his labour, and his talents in the manner most conducive to his interests, is an inestimable advantage; canals are cut, and railroads constructed, by the voluntary association of persons whose local knowledge enables them to place them in the most desirable situations; and these great advantages cannot exist under less free governments. These circumstances, when taken together, give such a decided superiority to our people, that no injurious rivalry, either in the construction of machinery or the manufacture of commodities, can reasonably be anticipated."[1]

As well, we think, might the attempt be made to transplant the political institutions of these United States into countries where the moral tone of the people at large is not sufficiently elevated to admit of their operation, as to introduce new and complex mechanical contrivances among those whose intellects have not been sufficiently cultivated to use them to the best advantage. An extreme case, illustrating this position, we have somewhere met with, in an account given by a British officer or missionary, of a visit to the coast of Patagonia, or some other portion of the South American continent. The officer was very desirous of teaching an Indian girl, the daughter of a chief, the very useful, and, as we formerly supposed, very simple art of sewing with a needle and thread. It was in vain, however, that he showed her, time after time, how to pass the threaded needle through the cloth; for, as soon as he placed it in her hands again, she invariably persisted in first inserting the needle, and then withdrawing it, endeavouring to push the end of the thread through the puncture in the cloth. Though filled with zeal to extend the arts of civilisation, the officer was at last compelled to abandon his well-intentioned but unsuccessful efforts in that direction.

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[1] Babbage "On the Economy of Machinery and Manufactures," pages 261, &c. Carey & Lea's American edition, 1832.

The immediate descendants of those by whom the arts and sciences have been so rapidly and extensively developed, our own countrymen, I am happy to say, show no lack of intellectual or physical capacity to invent or apply means of abridging labour. We have the assurances of some of our most successful practical manufacturers and machinists, that their American workmen are almost invariably the readiest to acquire a knowledge and sleight in the use of tools, and as this evidence was furnished by candid men, without the least intention to boast, it affords additional proof to the many derived from other sources, that the claims of the British committee, of their unrivaled skill, unequaled industry, and unparalleled ingenuity, will be sooner disputed than they have perhaps vainly imagined.

From such views relating to the arts, let us now indulge ourselves for a little while in considering some of the results derived from the application of philosophical research directed to gaining a knowledge of the conditions of our planet at various periods of its history.

To a common observer, the world would seem to be the theatre of perpetual mutation, in which there was nothing free from change and destruction. This, however, is less the case than is here imagined. The word destruction, as ordinarily used, implies a mere change of condition and separation of ingredients, which are left to enter into new combinations. The oil and fuel which give us light and heat, undergo apparent destruction, for the eye sees nothing passing off during their combustion, and at its conclusion finds nothing left but an inconsiderable portion of ashes. But if the invisible gases proceeding from the lamp and fire be collected under a proper receiver, their weight, in conjunction with that of the remaining ashes, will be found precisely equal to the original weight of the oil and coal that have disappeared. Inquiries pushed into the most distant periods which furnish any accurate data, warrant us in believing that the laws and agencies of nature are, in themselves, unchangeable. Constantly operating in breaking up old arrangements of matter and reassembling their elements into new forms, not a single atom has been lost to our world.

That the physical condition of our planet underwent many and mighty changes prior to its occupation by our species, has been clearly revealed to us by the researches of the geologist, who, although unable to penetrate into the crust of the earth but an exceedingly small distance, has, in this mere skim of the surface, developed wonderful things and sublime subjects for contemplation. He has found solid rocks, which seem to have constituted, as it were, the foundations of the earth, laid down before the existence of plant or animal. Over this he has traced a succession of layers, formed from the washings and fragments of the primeval formation, the first or lowermost strata exhibiting vestiges of vegetable life only, the next both vegetable and animal relics. The examination of these successive strata afford conclusive evidences that a series of periods of unknown duration once subsisted, in which both land and sea teemed with vegetable and animal life, which have successively undergone extinction, and been replaced by new forms and races, each putting on more and more resemblance to those now existing.

As if these revelations of the naturalist were not enough to astound our comprehension and defy the efforts of human reason, he has shown us skeletons of animals and remains of vegetables collected from parts of the earth where they can no longer exist in the present condition of things,—those, for example, of the elephant and palm within the northern regions,—affording, at once, direct proof that these now dreary and ungenial places were not always so, but once,—when there was no man to witness it,—enjoyed a climate, the temperature of which was at least equal to that now prevailing within the tropics.

But the graves of former creations have not remained in that peaceful repose, in which they would seem to have been formed, through quiet deposition at the bottom of a sea. It might naturally be supposed that strata deposited under such conditions would always be found in horizontal positions. This, however, is seldom the case, and they are generally met with bent and inclined more or less to the horizon,—some even perpendicular to it; others having broken, the fractured portions lying more or less out of their original positions. These facts reveal to us most conclusively that our earth was formerly subjected to violent disturbances and convulsive upheavings, and those elevations we term mountains, may be regarded as portions of the crust which, once thrown up, have never again settled to the general level. The production of these sublime commotions is generally ascribed to the agency of internal fire.

Since man has been a denizen of earth, it has never been subjected to any of those general perturbations formerly experienced. One flood has, indeed, swept over it, so that he and the other races of animals were only preserved from extinction by Divine interposition. Independently of this, the terrestrial crust has suffered only partial disturbance from earthquakes and volcanic eruptions.

We are in want of physical data, by which we can deduce the condition of things at the very origin of our present system. But that some of the general agents of nature have been operating with precisely the same energy from a period of high antiquity, can be demonstrated through the aids afforded by modern science. The interesting fact, that in descending below the surface of the earth in every part of the globe, the thermometer at certain depths,--say about eighty or ninety feet in the temperate zones,—ceases to exhibit either diurnal or annual change of temperature, maintaining invariably the same degree, and even the same fraction of a degree all the year round, and during a succession of years, Arago, the most prominent French philosopher of the present day, thinks can only be ascribed to the effect of original heat appertaining to the earth itself, solar influence being entirely incompetent to explain the phenomenon. Upon the supposition that the earth has once been in a state of incandescence, no means have yet been found by which the lapse of ages it has been cooling down can be ascertained. The immensity of time that the refrigeration must have required, supposing the rate always the same, may be inferred from the fact demonstrated by the great La Place, that in two thousand years the general temperature of the mass of the earth cannot have varied the tenth part of a degree on the thermometric scale!

In adverting to the happy moral agencies exerted by philosophical studies, I might have taken occasion to observe, that they also exert a strong religious influence upon every well-constituted mind. For the most scrutinising inquiry into every form of animate and inanimate existence, from the smallest atom to the great bodies which we contemplate wheeling in celestial space, present innumerable and irresistible evidences of design, and the existence and controlling power of a Great Supreme.

I hope I have said enough to prove, that for prosperity and security, nations are mainly dependent upon the intellectual capacities and acquirements of their citizens. We have never known or heard of one that has not experienced its days of trial, and it cannot be supposed that our own country, whose hills and valleys now rejoice in the possession of peace and abundance, can be always exempt from calamity. If ever driven by adverse fortune to fearful extremity, happy will it be for her, if, in that day, she can, like France at the crisis referred to, or like England,—sustained during her long and dreadful conflicts by the resources furnished through her Watt,—be rescued by her philosophers! Let us, therefore, like France, and the mighty people from whom we chiefly spring, use all our efforts to foster and diffuse the arts and sciences, and to banish the word "*impossible*" from our vocabulary.